SPEC CPU®2017 Integer Rate Result

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NEC Corporation

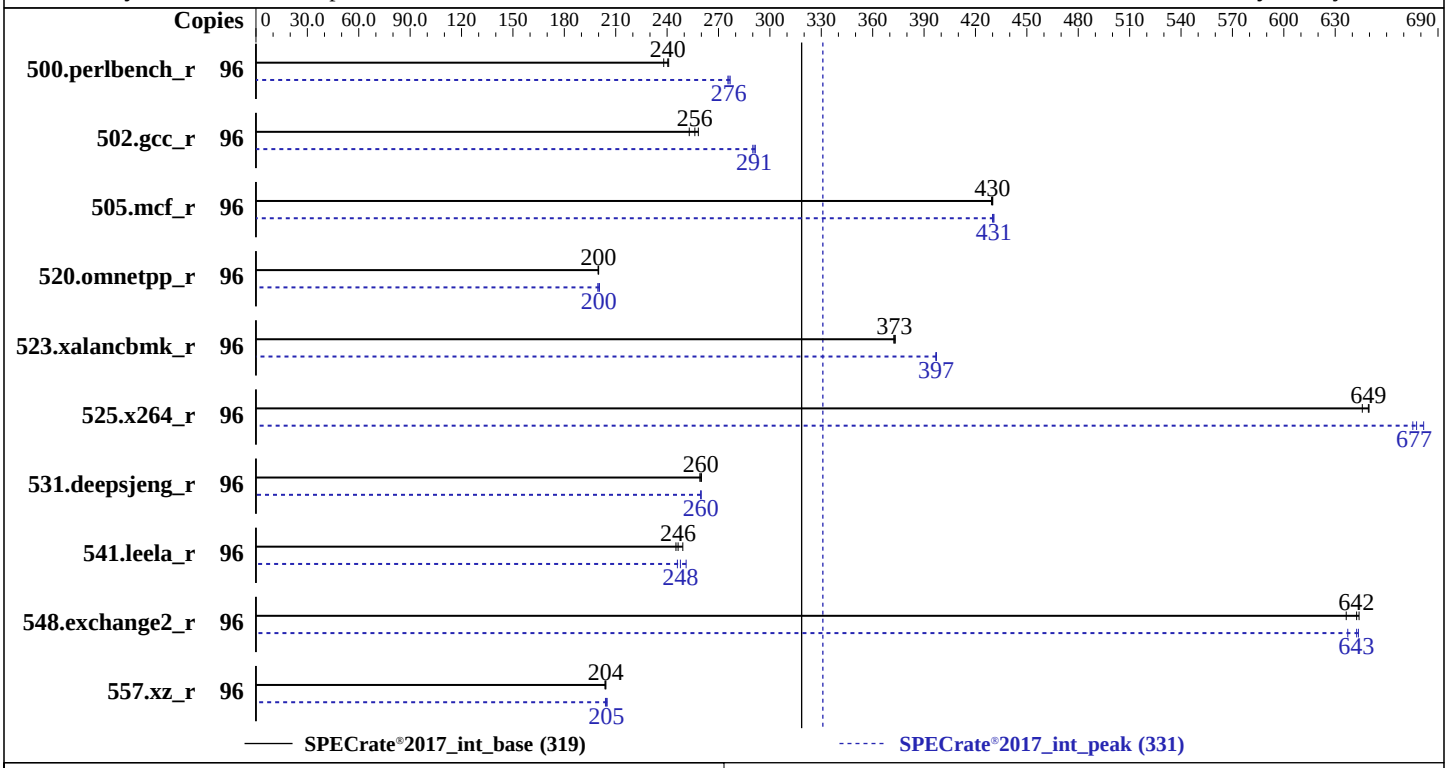
NX7700x/A5012M-4 v2
(Intel Xeon Gold 6226, 2.70GHz)

SPECrate®2017_int_base = 319

SPECrate®2017_int_peak = 331

CPU2017 License: 9006
Test Sponsor: NEC Corporation
Tested by: NEC Corporation

Test Date: Dec-2019
Hardware Availability: Oct-2019
Software Availability: May-2019



Hardware

CPU Name:	Intel Xeon Gold 6226
Max MHz:	3700
Nominal:	2700
Enabled:	48 cores, 4 chips, 2 threads/core
Orderable:	2,3,4 chips
Cache L1:	32 KB I + 32 KB D on chip per core
L2:	1 MB I+D on chip per core
L3:	19.25 MB I+D on chip per chip
Other:	None
Memory:	1536 GB (48 x 32 GB 2Rx4 PC4-2666V-R)
Storage:	800 GB tmpfs
Other:	None

Software

OS:	Red Hat Enterprise Linux Server release 7.6 (Maipo) Kernel 3.10.0-957.10.1.el7.x86_64
Compiler:	C/C++: Version 19.0.4.227 of Intel C/C++ Compiler Build 20190416 for Linux; Fortran: Version 19.0.4.227 of Intel Fortran Compiler Build 20190416 for Linux
Parallel:	No
Firmware:	NEC BIOS Version 5.7.0210 08/27/2019 released Oct-2019
File System:	tmpfs
System State:	Run level 3 (multi-user)
Base Pointers:	64-bit
Peak Pointers:	32/64-bit
Other:	jemalloc memory allocator V5.0.1
Power Management:	BIOS and OS set to prefer performance at the cost of additional power usage.

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Results Table

Benchmark	Base							Peak						
	Copies	Seconds	Ratio	Seconds	Ratio	Seconds	Ratio	Copies	Seconds	Ratio	Seconds	Ratio	Seconds	Ratio
500.perlbench_r	96	**636**	**240**	634	241	642	238	96	**554**	**276**	552	277	555	275
502.gcc_r	96	537	253	**531**	**256**	526	258	96	469	290	466	292	**468**	**291**
505.mcf_r	96	361	430	**361**	**430**	361	429	96	**360**	**431**	361	430	360	431
520.omnetpp_r	96	630	200	631	200	**630**	**200**	96	**629**	**200**	631	200	628	201
523.xalancbmk_r	96	**272**	**373**	272	373	272	372	96	255	397	**255**	**397**	255	397
525.x264_r	96	**259**	**649**	260	646	259	650	96	247	682	**248**	**677**	249	675
531.deepsjeng_r	96	423	260	425	259	**424**	**260**	96	424	260	423	260	**424**	**260**
541.leela_r	96	638	249	**645**	**246**	648	245	96	646	246	633	251	**642**	**248**
548.exchange2_r	96	391	644	395	636	**391**	**642**	96	395	637	391	644	**391**	**643**
557.xz_r	96	**508**	**204**	508	204	509	204	96	**507**	**205**	508	204	506	205

SPECrate®2017_int_base = 319

SPECrate®2017_int_peak = 331

Results appear in the order in which they were run. Bold underlined text indicates a median measurement.

Submit Notes

```
The numactl mechanism was used to bind copies to processors. The config file option 'submit'
was used to generate numactl commands to bind each copy to a specific processor.
For details, please see the config file.
```

Operating System Notes

```
Stack size set to unlimited using "ulimit -s unlimited"
Tmpfs filesystem can be set with:
mount -t tmpfs -o size=800g tmpfs /home
cpupower -c all frequency-set -g performance
VM Dirty ratio was set to 40 using "echo 40 > /proc/sys/vm/dirty_ratio"
Set Kernel Boot Parameter : nohz_full=1-143
irqbalance disabled with "service irqbalance stop"
echo 50000     > /proc/sys/kernel/sched_cfs_bandwidth_slice_us
echo 240000000 > /proc/sys/kernel/sched_latency_ns
echo 5000000   > /proc/sys/kernel/sched_migration_cost_ns
echo 100000000 > /proc/sys/kernel/sched_min_granularity_ns
echo 150000000 > /proc/sys/kernel/sched_wakeup_granularity_ns
echo 0 > /proc/sys/kernel/numa_balancing
```

Environment Variables Notes

```
Environment variables set by runcpu before the start of the run:
LD_LIBRARY_PATH =
     "/home/SPEC/lib/intel64:/home/SPEC/lib/ia32:/home/SPEC/je5.0.1-32"
```

General Notes

```
 Binaries compiled on a system with 1x Intel Core i9-7900X CPU + 32GB RAM
 memory using Redhat Enterprise Linux 7.5
 Transparent Huge Pages enabled by default
 Prior to runcpu invocation
 Filesystem page cache synced and cleared with:
 sync; echo 3 >       /proc/sys/vm/drop_caches
 runcpu command invoked through numactl i.e.:
 numactl --interleave=all runcpu <etc>

NA: The test sponsor attests, as of date of publication, that CVE-2017-5754 (Meltdown)
is mitigated in the system as tested and documented.
Yes: The test sponsor attests, as of date of publication, that CVE-2017-5753 (Spectre variant 1)
is mitigated in the system as tested and documented.
Yes: The test sponsor attests, as of date of publication, that CVE-2017-5715 (Spectre variant 2)
is mitigated in the system as tested and documented.
 jemalloc, a general purpose malloc implementation
 built with the RedHat Enterprise 7.5, and the system compiler gcc 4.8.5
 sources available from jemalloc.net or https://github.com/jemalloc/jemalloc/releases
```

Platform Notes

```
 BIOS Settings:
  Memory RAS Mode: SDDC mode
  VT-x : Disabled
  Processor C6 Report : Disabled
  OS Performance Tuning : Disabled
  Energy Performance : Performance
  Patrol Scrub : Disabled
  DCU Streamer Prefetcher : Disabled
  Memory P.E. Retry : Disabled
  Sub NUMA Clustering : Enabled
  Turbo Boost : Enabled

 Sysinfo program /home/SPEC/bin/sysinfo
 Rev: r6365 of 2019-08-21 295195f888a3d7edb1e6e46a485a0011
 running on localhost.localdomain Tue Dec 17 19:52:08 2019

 SUT (System Under Test) info as seen by some common utilities.
 For more information on this section, see
    https://www.spec.org/cpu2017/Docs/config.html#sysinfo

 From /proc/cpuinfo
    model name : Intel(R) Xeon(R) Gold 6226 CPU @ 2.70GHz
       4  "physical id"s (chips)
       96 "processors"
    cores, siblings (Caution: counting these is hw and system dependent. The following
```

(Continued on next page)

Platform Notes (Continued)

```
    excerpts from /proc/cpuinfo might not be reliable.  Use with caution.)
       cpu cores : 12
       siblings  : 24
       physical 0: cores 1 2 3 4 5 6 8 9 10 11 12 13
       physical 1: cores 0 1 2 3 4 5 6 8 10 11 13 14
       physical 2: cores 1 2 3 4 5 6 8 9 10 11 12 13
       physical 3: cores 1 2 3 4 5 8 9 10 11 12 13 14

  From lscpu:
       Architecture:          x86_64
       CPU op-mode(s):        32-bit, 64-bit
       Byte Order:            Little Endian
       CPU(s):                96
       On-line CPU(s) list:   0-95
       Thread(s) per core:    2
       Core(s) per socket:    12
       Socket(s):             4
       NUMA node(s):          8
       Vendor ID:             GenuineIntel
       CPU family:            6
       Model:                 85
       Model name:            Intel(R) Xeon(R) Gold 6226 CPU @ 2.70GHz
       Stepping:              7
       CPU MHz:               2701.000
       CPU max MHz:           2701.0000
       CPU min MHz:           1200.0000
       BogoMIPS:              5400.00
       Virtualization:        VT-x
       L1d cache:             32K
       L1i cache:             32K
       L2 cache:              1024K
       L3 cache:              19712K
       NUMA node0 CPU(s):     0-2,6-8,48-50,54-56
       NUMA node1 CPU(s):     3-5,9-11,51-53,57-59
       NUMA node2 CPU(s):     12-15,19,20,60-63,67,68
       NUMA node3 CPU(s):     16-18,21-23,64-66,69-71
       NUMA node4 CPU(s):     24-26,30-32,72-74,78-80
       NUMA node5 CPU(s):     27-29,33-35,75-77,81-83
       NUMA node6 CPU(s):     36-38,41-43,84-86,89-91
       NUMA node7 CPU(s):     39,40,44-47,87,88,92-95
       Flags:                 fpu vme de pse tsc msr pae mce cx8 apic sep mtrr pge mca cmov
       pat pse36 clflush dts acpi mmx fxsr sse sse2 ss ht tm pbe syscall nx pdpe1gb rdtscp
       lm constant_tsc art arch_perfmon pebs bts rep_good nopl xtopology nonstop_tsc
       aperfmperf eagerfpu pni pclmulqdq dtes64 monitor ds_cpl vmx smx est tm2 ssse3 sdbg
       fma cx16 xtpr pdcm pcid dca sse4_1 sse4_2 x2apic movbe popcnt tsc_deadline_timer aes
       xsave avx f16c rdrand lahf_lm abm 3dnowprefetch epb cat_l3 cdp_l3 intel_pt ssbd mba
       ibrs ibpb stibp ibrs_enhanced tpr_shadow vnmi flexpriority ept vpid fsgsbase
```

(Continued on next page)

Platform Notes (Continued)

```
      tsc_adjust bmi1 hle avx2 smep bmi2 erms invpcid rtm cqm mpx rdt_a avx512f avx512dq
      rdseed adx smap clflushopt clwb avx512cd avx512bw avx512vl xsaveopt xsavec xgetbv1
      cqm_llc cqm_occup_llc cqm_mbm_total cqm_mbm_local dtherm ida arat pln pts pku ospke
      avx512_vnni spec_ctrl intel_stibp flush_l1d arch_capabilities

 /proc/cpuinfo cache data
    cache size : 19712 KB

 From numactl --hardware  WARNING: a numactl 'node' might or might not correspond to a
 physical chip.
   available: 8 nodes (0-7)
   node 0 cpus: 0 1 2 6 7 8 48 49 50 54 55 56
   node 0 size: 195209 MB
   node 0 free: 190475 MB
   node 1 cpus: 3 4 5 9 10 11 51 52 53 57 58 59
   node 1 size: 196608 MB
   node 1 free: 190314 MB
   node 2 cpus: 12 13 14 15 19 20 60 61 62 63 67 68
   node 2 size: 196608 MB
   node 2 free: 192232 MB
   node 3 cpus: 16 17 18 21 22 23 64 65 66 69 70 71
   node 3 size: 196608 MB
   node 3 free: 191353 MB
   node 4 cpus: 24 25 26 30 31 32 72 73 74 78 79 80
   node 4 size: 196608 MB
   node 4 free: 192276 MB
   node 5 cpus: 27 28 29 33 34 35 75 76 77 81 82 83
   node 5 size: 196608 MB
   node 5 free: 191659 MB
   node 6 cpus: 36 37 38 41 42 43 84 85 86 89 90 91
   node 6 size: 196608 MB
   node 6 free: 192252 MB
   node 7 cpus: 39 40 44 45 46 47 87 88 92 93 94 95
   node 7 size: 196608 MB
   node 7 free: 191428 MB
   node distances:
   node   0   1   2   3   4   5   6   7
     0:  10  11  15  15  15  15  15  15
     1:  11  10  15  15  15  15  15  15
     2:  15  15  10  11  15  15  15  15
     3:  15  15  11  10  15  15  15  15
     4:  15  15  15  15  10  11  15  15
     5:  15  15  15  15  11  10  15  15
     6:  15  15  15  15  15  15  10  11
     7:  15  15  15  15  15  15  11  10

 From /proc/meminfo
```

(Continued on next page)

Platform Notes (Continued)

```
    MemTotal:       1583672932 kB
    HugePages_Total:       0
    Hugepagesize:       2048 kB

  From /etc/*release* /etc/*version*
    os-release:
       NAME="Red Hat Enterprise Linux Server"
       VERSION="7.6 (Maipo)"
       ID="rhel"
       ID_LIKE="fedora"
       VARIANT="Server"
       VARIANT_ID="server"
       VERSION_ID="7.6"
       PRETTY_NAME="Red Hat Enterprise Linux Server 7.6 (Maipo)"
    redhat-release: Red Hat Enterprise Linux Server release 7.6 (Maipo)
    system-release: Red Hat Enterprise Linux Server release 7.6 (Maipo)
    system-release-cpe: cpe:/o:redhat:enterprise_linux:7.6:ga:server

  uname -a:
    Linux localhost.localdomain 3.10.0-957.10.1.el7.x86_64 #1 SMP Thu Feb 7 07:12:53 UTC
    2019 x86_64 x86_64 x86_64 GNU/Linux

  Kernel self-reported vulnerability status:

  CVE-2018-3620 (L1 Terminal Fault):        Not affected
  Microarchitectural Data Sampling:         No status reported
  CVE-2017-5754 (Meltdown):                 Not affected
  CVE-2018-3639 (Speculative Store Bypass): Mitigation: Speculative Store Bypass disabled
                                            via prctl and seccomp
  CVE-2017-5753 (Spectre variant 1):        Mitigation: Load fences, __user pointer
                                            sanitization
  CVE-2017-5715 (Spectre variant 2):        Mitigation: Enhanced IBRS

  run-level 3 Dec 17 19:31

  SPEC is set to: /home/SPEC
    Filesystem     Type   Size  Used Avail Use% Mounted on
    tmpfs          tmpfs  800G  4.2G  796G   1% /home

  From /sys/devices/virtual/dmi/id
     BIOS:    American Megatrends Inc. 5.7.0210 08/27/2019
     Vendor:  NEC
     Product: NX7700x/A5012M-4 v2 [NE3400-401Y]
     Serial:  7800115

  Additional information from dmidecode follows.  WARNING: Use caution when you interpret
  this section. The 'dmidecode' program reads system data which is "intended to allow
```

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Platform Notes (Continued)

```
 hardware to be accurately determined", but the intent may not be met, as there are
 frequent changes to hardware, firmware, and the "DMTF SMBIOS" standard.
   Memory:
     48x Samsung M393A4K40BB2-CTD 32 GB 2 rank 2666

 (End of data from sysinfo program)
```

Compiler Version Notes

```
==============================================================================
C       | 502.gcc_r(peak)
------------------------------------------------------------------------------
Intel(R) C Intel(R) 64 Compiler for applications running on IA-32, Version
  19.0.4.227 Build 20190416
Copyright (C) 1985-2019 Intel Corporation.  All rights reserved.
------------------------------------------------------------------------------

==============================================================================
C       | 500.perlbench_r(base, peak) 502.gcc_r(base) 505.mcf_r(base, peak)
        | 525.x264_r(base, peak) 557.xz_r(base, peak)
------------------------------------------------------------------------------
Intel(R) C Intel(R) 64 Compiler for applications running on Intel(R) 64,
  Version 19.0.4.227 Build 20190416
Copyright (C) 1985-2019 Intel Corporation.  All rights reserved.
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------------------------------------------------------------------------------

==============================================================================
C       | 500.perlbench_r(base, peak) 502.gcc_r(base) 505.mcf_r(base, peak)
        | 525.x264_r(base, peak) 557.xz_r(base, peak)
------------------------------------------------------------------------------
Intel(R) C Intel(R) 64 Compiler for applications running on Intel(R) 64,
  Version 19.0.4.227 Build 20190416
Copyright (C) 1985-2019 Intel Corporation.  All rights reserved.
------------------------------------------------------------------------------

==============================================================================
C++     | 523.xalancbmk_r(peak)
------------------------------------------------------------------------------
```

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Compiler Version Notes (Continued)

```
Intel(R) C++ Intel(R) 64 Compiler for applications running on IA-32, Version
  19.0.4.227 Build 20190416
Copyright (C) 1985-2019 Intel Corporation.  All rights reserved.
------------------------------------------------------------------------------

==============================================================================
C++      | 520.omnetpp_r(base, peak) 523.xalancbmk_r(base)
         | 531.deepsjeng_r(base, peak) 541.leela_r(base, peak)
------------------------------------------------------------------------------
Intel(R) C++ Intel(R) 64 Compiler for applications running on Intel(R) 64,
  Version 19.0.4.227 Build 20190416
Copyright (C) 1985-2019 Intel Corporation.  All rights reserved.
------------------------------------------------------------------------------

==============================================================================
C++      | 523.xalancbmk_r(peak)
------------------------------------------------------------------------------
Intel(R) C++ Intel(R) 64 Compiler for applications running on IA-32, Version
  19.0.4.227 Build 20190416
Copyright (C) 1985-2019 Intel Corporation.  All rights reserved.
------------------------------------------------------------------------------

==============================================================================
C++      | 520.omnetpp_r(base, peak) 523.xalancbmk_r(base)
         | 531.deepsjeng_r(base, peak) 541.leela_r(base, peak)
------------------------------------------------------------------------------
Intel(R) C++ Intel(R) 64 Compiler for applications running on Intel(R) 64,
  Version 19.0.4.227 Build 20190416
Copyright (C) 1985-2019 Intel Corporation.  All rights reserved.
------------------------------------------------------------------------------

==============================================================================
Fortran | 548.exchange2_r(base, peak)
------------------------------------------------------------------------------
Intel(R) Fortran Intel(R) 64 Compiler for applications running on Intel(R)
  64, Version 19.0.4.227 Build 20190416
Copyright (C) 1985-2019 Intel Corporation.  All rights reserved.
------------------------------------------------------------------------------
```

Base Compiler Invocation

C benchmarks:
`icc -m64 -std=c11`

C++ benchmarks:
`icpc -m64`

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Base Compiler Invocation (Continued)

Fortran benchmarks:
ifort -m64

Base Portability Flags

500.perlbench_r: -DSPEC_LP64 -DSPEC_LINUX_X64
502.gcc_r: -DSPEC_LP64
505.mcf_r: -DSPEC_LP64
520.omnetpp_r: -DSPEC_LP64
523.xalancbmk_r: -DSPEC_LP64 -DSPEC_LINUX
525.x264_r: -DSPEC_LP64
531.deepsjeng_r: -DSPEC_LP64
541.leela_r: -DSPEC_LP64
548.exchange2_r: -DSPEC_LP64
557.xz_r: -DSPEC_LP64

Base Optimization Flags

C benchmarks:
-Wl,-z,muldefs -xCORE-AVX512 -ipo -O3 -no-prec-div
-qopt-mem-layout-trans=4
-L/usr/local/IntelCompiler19/compilers_and_libraries_2019.4.227/linux/compiler/lib/intel64
-lqkmalloc

C++ benchmarks:
-Wl,-z,muldefs -xCORE-AVX512 -ipo -O3 -no-prec-div
-qopt-mem-layout-trans=4
-L/usr/local/IntelCompiler19/compilers_and_libraries_2019.4.227/linux/compiler/lib/intel64
-lqkmalloc

Fortran benchmarks:
-Wl,-z,muldefs -xCORE-AVX512 -ipo -O3 -no-prec-div
-qopt-mem-layout-trans=4 -nostandard-realloc-lhs -align array32byte
-L/usr/local/IntelCompiler19/compilers_and_libraries_2019.4.227/linux/compiler/lib/intel64
-lqkmalloc

Peak Compiler Invocation

C benchmarks (except as noted below):
`icc -m64 -std=c11`

502.gcc_r: `icc -m32 -std=c11 -L/usr/local/IntelCompiler19/compilers_and_libraries_2019.4.227/linux/compiler/lib/ia32_lin`

C++ benchmarks (except as noted below):
`icpc -m64`

523.xalancbmk_r: `icpc -m32 -L/usr/local/IntelCompiler19/compilers_and_libraries_2019.4.227/linux/compiler/lib/ia32_lin`

Fortran benchmarks:
`ifort -m64`

Peak Portability Flags

500.perlbench_r: `-DSPEC_LP64 -DSPEC_LINUX_X64`
502.gcc_r: `-D_FILE_OFFSET_BITS=64`
505.mcf_r: `-DSPEC_LP64`
520.omnetpp_r: `-DSPEC_LP64`
523.xalancbmk_r: `-D_FILE_OFFSET_BITS=64 -DSPEC_LINUX`
525.x264_r: `-DSPEC_LP64`
531.deepsjeng_r: `-DSPEC_LP64`
541.leela_r: `-DSPEC_LP64`
548.exchange2_r: `-DSPEC_LP64`
557.xz_r: `-DSPEC_LP64`

Peak Optimization Flags

C benchmarks:

500.perlbench_r: `-Wl,-z,muldefs -prof-gen`(pass 1) `-prof-use`(pass 2) `-ipo -xCORE-AVX512 -O3 -no-prec-div -qopt-mem-layout-trans=4 -fno-strict-overflow -L/usr/local/IntelCompiler19/compilers_and_libraries_2019.4.227/linux/compiler/lib/intel64 -lqkmalloc`

502.gcc_r: `-Wl,-z,muldefs -prof-gen`(pass 1) `-prof-use`(pass 2) `-ipo -xCORE-AVX512 -O3 -no-prec-div -qopt-mem-layout-trans=4 -L/usr/local/je5.0.1-32/lib -ljemalloc`

505.mcf_r: `-Wl,-z,muldefs -xCORE-AVX512 -ipo -O3 -no-prec-div -qopt-mem-layout-trans=4`

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Peak Optimization Flags (Continued)

505.mcf_r (continued):
-L/usr/local/IntelCompiler19/compilers_and_libraries_2019.4.227/linux/compiler/lib/intel64
-lqkmalloc

525.x264_r: -Wl,-z,muldefs -xCORE-AVX512 -ipo -O3 -no-prec-div
-qopt-mem-layout-trans=4 -fno-alias
-L/usr/local/IntelCompiler19/compilers_and_libraries_2019.4.227/linux/compiler/lib/intel64
-lqkmalloc

557.xz_r: Same as 505.mcf_r

C++ benchmarks:

520.omnetpp_r: -Wl,-z,muldefs -xCORE-AVX512 -ipo -O3 -no-prec-div
-qopt-mem-layout-trans=4
-L/usr/local/IntelCompiler19/compilers_and_libraries_2019.4.227/linux/compiler/lib/intel64
-lqkmalloc

523.xalancbmk_r: -Wl,-z,muldefs -prof-gen(pass 1) -prof-use(pass 2) -ipo
-xCORE-AVX512 -O3 -no-prec-div -qopt-mem-layout-trans=4
-L/usr/local/je5.0.1-32/lib -ljemalloc

531.deepsjeng_r: Same as 520.omnetpp_r

541.leela_r: Same as 520.omnetpp_r

Fortran benchmarks:
-Wl,-z,muldefs -xCORE-AVX512 -ipo -O3 -no-prec-div
-qopt-mem-layout-trans=4 -nostandard-realloc-lhs -align array32byte
-L/usr/local/IntelCompiler19/compilers_and_libraries_2019.4.227/linux/compiler/lib/intel64
-lqkmalloc

The flags files that were used to format this result can be browsed at
http://www.spec.org/cpu2017/flags/Intel-ic19.0u1-official-linux64.2019-07-09.html
http://www.spec.org/cpu2017/flags/NEC-Platform-Settings-SPECcpu2017-Flags-V1.2-CLX-A5012M-4-RevC.html

You can also download the XML flags sources by saving the following links:
http://www.spec.org/cpu2017/flags/Intel-ic19.0u1-official-linux64.2019-07-09.xml
http://www.spec.org/cpu2017/flags/NEC-Platform-Settings-SPECcpu2017-Flags-V1.2-CLX-A5012M-4-RevC.xml

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For questions about this result, please contact the tester. For other inquiries, please contact info@spec.org.

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